



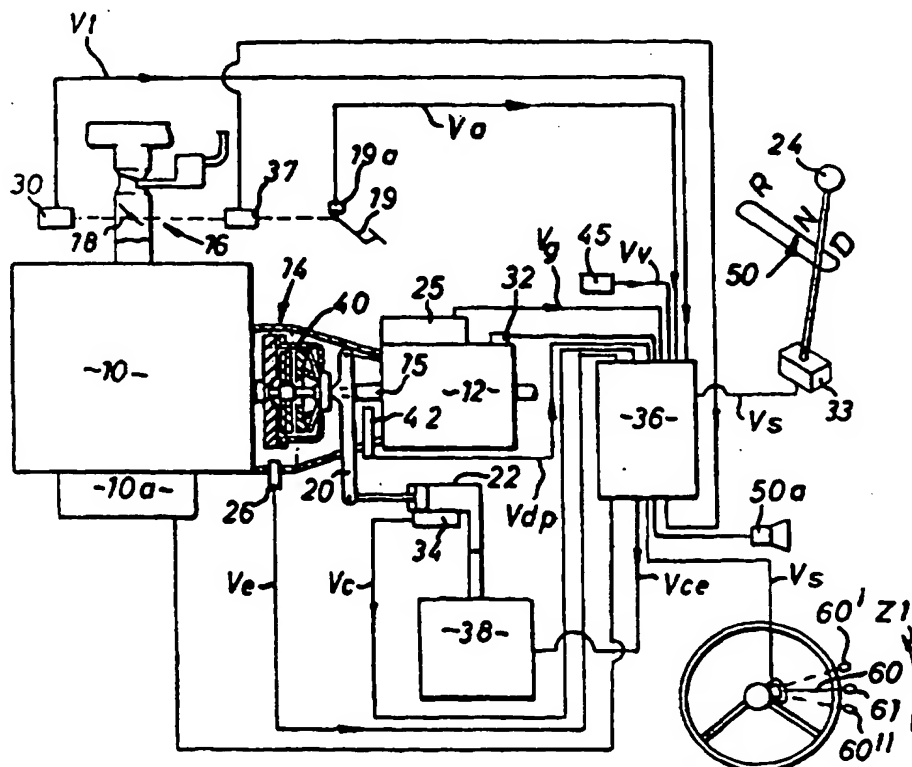
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(54) Title: VEHICLE TRANSMISSIONS

(57) Abstract

A vehicle transmission having a main drive clutch (14), a multi-ratio gearbox (12), a gear engaging mechanism (25) for engaging the operative ratio of the gearbox, a manually operable gear selector (60) allowing the operator to manually select the operative ratio of the gearbox when the transmission is acting in a manual mode, and an electronic control means (36) which controls the disengagement and engagement of the drive clutch at start-up and halting of the associated vehicle and during gear changes and which also determines which gear ratio is to be selected when the transmission is acting in an automatic mode. The manually operable gear selector (60), which may be steering column mounted, is also arranged to enable the operator to override the current automatically selected ratio, and the transmission then remains in manual mode if an override is actioned until the operator switches the transmission back to its automatic mode or a predetermined time period has elapsed.



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VEHICLE TRANSMISSIONS

This invention relates to vehicle transmissions which include a multi-ratio gearbox and in particular to transmissions which have an automatic ratio selection mode.

It is an object of the present invention to provide an improved form of vehicle transmission.

Thus according to the present invention there is provided a vehicle transmission comprising a main drive clutch, a multi-ratio gearbox, a gear engaging mechanism for engaging the operative ratio of the gearbox, a manually operable gear selector allowing the operator to manually select the operative ratio of the gearbox when the transmission is acting in a manual mode, and an electronic control means which controls the disengagement and engagement of the drive clutch at start-up and halting of the associated vehicle and during gear changes and which also determines which gear ratio is to be selected when the transmission is acting in an automatic mode, the transmission being characterised in that the manually operable gear selector is arranged to enable the operator to override the current automatically selected ratio, and the transmission then remains in manual mode if an override is actioned until the operator switches

the transmission back to its automatic mode or a predetermined time period has elapsed.

Preferably the operator overrides the automatically selected ratio using a steering column-mounted stalk which is moved in a first direction to change the currently operative ratio upwards and in a second direction to change the currently operative ratio downwards.

The stalk may also carry a manual/auto selection member to switch between the manual and automatic modes of the transmission.

This manual/auto selection member preferably comprises a button on the end of the stalk which switches between the manual and automatic modes on each successive depression of the button.

Preferably a visual display is provided which indicates whether manual or automatic mode is operative. This display will also preferably indicate when reverse or neutral are selected in the auto mode and which ratio is currently selected when in the manual mode.

The stalk may be rotatable about its longitudinal axis to predetermined rotational positions which select neutral, drive and reverse drive conditions when in automatic mode in

addition to being pivotable in the first and second directions about an axis perpendicular to its longitudinal axis to shift upwards and downwards in the transmission.

If the transmission is in neutral moving the stalk or button will not give a drive condition to guard against accidental movement of the associated vehicle.

If in the manual mode the electronic control means will automatically intervene to change up if a predetermined engine speed (eg. 6.2K rpm) is exceeded and to change down if engine speed drops below a second predetermined engine speed (eg. in the range 0.8K rpm to 1.05K r.p.m.).

The present invention will now be described by way of example only, with reference to the accompanying drawings in which:-

Fig 1 shows in diagrammatic form the general layout of a vehicle transmission embodying the present invention;

Fig 2 shows in flow diagram form the operation of the drive mode selection;

Fig 3 shows diagrammatically the generation of the clutch engagement control signal, and

Fig 4a to 4c show details of a column-mounted control

stalk used to manually select the operative ratio of the transmission.

Referring to Fig 1 this shows an engine 10 with a starter and an associated starter circuit 10a which is coupled through a friction clutch 14 with a five speed synchronised lay-shaft type gearbox 12 via a gearbox input shaft 15. In the example described, fuel is supplied to the engine by a throttle 16 which includes a throttle valve 18 operated by accelerator pedal 19. The invention is equally applicable to electronic or mechanical fuel injected petrol or diesel engines.

The clutch 14 is actuated by a release fork 20 which is operated by a slave cylinder 22 which is powered by an hydraulic control 38.

The selection of the operative ratio of the gearbox may be controlled automatically or manually.

A floor-mounted automatic-mode selector lever 24 operates in a gate 50 which has three positions; a 'N' position in which lever 24 is placed when it is desired to engage neutral when the vehicle is operating park in the automatic ratio selection mode (the vehicle can only be started when in neutral; an 'R' position in which the lever is placed to select reverse, and a 'D' position in which the lever is placed when it is desired that the forward drive ratio of the

gearbox should be selected automatically by an electronic control unit 36 in accordance with the current operating conditions of the vehicle. The position of lever 24 in gate 50 is sensed by a series of sensors (eg. micro switches and/or optical sensors) which are collectively indicated in Figure 1 at 33 and whose signal outputs Vs are fed to control unit 36. Signals are then issued from control unit 36 to a gear engaging mechanism 25 which includes, for example, hydraulic rams and solenoid control valves to move selector members to engage the desired gearbox ratio. One example of a suitable gear engaging mechanism is disclosed and claimed in the Applicants earlier co-pending UK Patent Application No. 952140.8.

When in the 'D' position the control unit 36 determines which ratio is most appropriate for the current vehicle operating conditions and issues appropriate ratio selection signals to gear engaging mechanism 25.

To determine the appropriate operating ratio control unit 36 receives signals from a plurality of vehicle operating parameter sensors such as signals Ve proportional to engine speed from engine speed sensor 26. Signals Vt are received from throttle valve position sensor 30 proportional to the current throttle opening and accelerator pedal position signals Va from an accelerator position sensor 19a are also fed to control unit 36. In certain implementations of the

system only one of the sensors 19a and 30 may be provided. Most commonly in such a situation it is sensor 19a which is provided.

Control unit 36 also receives a gear signal Vg from gear position sensor 32 which corresponds to the gear ratio currently engaged, signals Vc from slave cylinder position sensor 34, which varying with the position of the slave cylinder 22, and signals Vdp proportional to clutch driven plate speed from speed sensor 42 which actually senses the speed of the gearbox shaft 15 (which is equal to that of a driven plate 40 of the clutch 14). A vehicle speed sensor 45, for example of the variable reluctance type, is also provided to feed a vehicle speed signal Vv to the control unit 36. Again in certain implementations, driven plate sensor 42 may be omitted and the driven plate speed calculated by the control unit 36 from the vehicle speed and the gearbox ratio currently engaged.

A buzzer 50a is connected with control unit 36 to warn/indicate to the vehicle operator when certain vehicle operating conditions occur. In addition to or in place of buzzer 50a a flashing warning light (not shown) may be used and/or the instrument panel display may be arranged to flash.

As indicated above control unit 36 also controls the engagement and disengagement of the clutch 14. This is done

by the control unit 36 generating a reference signal V_r in a generator C (see figure 3) which is representative of a desired engine speed. This reference signal is compared in comparator A with the actual engine speed signal V_e from engine speed sensor 26 to produce an error signal E which is compared in comparator B with the clutch actuator position signal V_c from sensor 34 to provide a clutch engagement control signal V_{ce} which the control unit 36 outputs to the hydraulic control 38. Operation of a control unit 36 in this general manner is described in more detail, for example in the Applicants earlier European Patents 0038113 and 0043660.

In addition to controlling the engagement and disengagement of clutch 14 the control unit 36 also controls the throttle setting via a throttle control 37 when its control logic indicates that an override of the throttle opening set by the driver's operation of the accelerator 19 is desirable.

In accordance with the present invention the operative ratio of gearbox 12 can be selected manually via a steering column mounted control stalk 60 which is spring-biased to the central position shown in Figure 1 and which on each successive movement of stalk 60 in direction Z1 (see figs 4a & 4c) to position 60a sends a signal V_s to control unit 36 to change-up one ratio in the currently operative ratio of the gearbox and on each successive movement of the stalk 60 to position 60b sends a signal V_s to change-down one ratio in

the currently operative ratio. Additionally, or alternatively, stalk 60 may be movable in direction Z2 (at right angles to Z1) to positions 60c and 60d to make up and down changes respectively. If the stalk 60 is movable in both directions Z1 and Z2, up changes are initiated on movements to positions 60a and 60c and down changes on movements to positions 60b and 60d.

Stalk 60 can be used to manually override the ratio selected by control unit 36 when in automatic mode or to normally select the operative ratios when in the manual mode.

On the end of stalk 60 is mounted a button 61 which switches between manual and automatic modes of gear selection on each successive depression of the button as indicated by arrow M in Figure 4a. The primary use of this button is to switch back to automatic mode after manual mode operation but the button can also be used by the operator when he wishes to switch to manual mode without actioning a change in the currently operative gearbox ratio using stalk 60.

The transmission control may be set-up so that if manual control mode is selected by operating button 61 appropriately (or be movement of stalk 60 to override the ratio selected in Automatic mode) the control will remain in manual mode until button 61 is pressed to invoke the automatic mode control. Alternatively, the control may be set-up to automatically

revert to automatic mode after a predetermined time period of say 10 seconds in manual mode.

Figure 2 illustrates in flow diagram form the mode selection procedure. As indicated at box A, the control automatically assumes the automatic control mode when the vehicle ignition is switched on. The control remains in automatic mode until either the stalk 60 is moved to initiate an up or down change (box B) or the button 61 is pressed to invoke manual mode (box C).

When an up or down shift is selected by stalk 60, either via box B if in automotive mode, or box D if already in manual mode, the control 36 checks (see box E) that the selected ratio is appropriate for the current operating conditions (eg whether the engine is likely to overspeed or the load is too high for the selected ratio) and, if the selected ratio is deemed appropriate, actions the selected change in gearbox ratio.

Box F actions the return to automatic mode when the operator presses button 61 when in manual mode.

Preferably a visual display is provided which indicates when the control is operating in the Automatic drive ('D') mode, by the illumination of an 'A' light. Operation in the reverse condition is indicated by the illumination of an 'R'

light and the engagement of neutral by the illumination of an 'N' light. The visual display also preferably indicates which of the ratios of the gearbox is selected when in the manual mode by the illumination of the appropriate ratio number on, for example, an LED display.

When in the manual mode the control unit 36 may be arranged to automatically intervene to change up if a predetermined engine speed (eg. 6200 rpm) is exceeded and to change down if engine speed drops below a second predetermined engine speed (eg. in the range 800 rpm to 1050 rpm).

In a modified form of the control shown in Figure 4 the floor-mounted selector lever 24 is eliminated and the reverse, neutral and drive selection when in automatic mode are made by rotating stalk 60 about its longitudinal axis X as indicated by arrow Y in Figure 4a.

In this arrangement (see Fig 4b) the stalk 60 includes a gripping and indicating portion 62 which has two flat faces 62a and 62b marked REVERSE and DRIVE respectively and an intermediate curved portion 62c marked NEUTRAL. When curved portion 62c is in a predetermined position visible by the driver (e.g. facing generally upwards) this gives a signal to control unit 36 to select the neutral condition of the gearbox and rotation of stalk 60 in direction Y to place flat face 62a or 62b facing generally upwards selects the reverse

or drive conditions when in automatic mode.

Stalk 60 of Figure 4b is still movable in directions Z1 and/or Z2 to select an up or down change as previously described, and button 61 is still provided to switch between automatic and manual modes.

Stalk 60 is preferably arranged, when the reverse and neutral conditions are selected, to be either locked against movement in direction Z1 and/or Z2 or for any such movement to be ineffective at changing the operative ratio of the transmission.

As will be appreciated from the above stalk 60 provides all the controls over the gearbox ratio selection at a location which is convenient to the operator and leave the vehicle floor area clear.

In a further alternative instruction the stalk 60 may be moved in a column gate of the form shown in, for example Figure 5 or 6. This type of column gate avoids the need to rotate the stalk as indicated by arrow Y in Figures 4a and 4b.

If desired, the lever 24 and stalk 60 may also have a 'P' or park position in which the lever or stalk is placed when the vehicle is parked. When in the park position the associated

gearbox 12 may be arranged to engage reverse and the clutch 14 may be arranged to be engaged when the engine 10 is turned-off to provide in effect a transmission parking brake by leaving the gearbox "in gear".

In a still further alternative arrangement the reverse, neutral, drive (and park when provided) modes may be selected by selector buttons provided on, for example, the dashboard of the vehicle.

CLAIMS

- 1) A vehicle transmission comprising a main drive clutch (14), a multi-ratio gearbox (12), a gear engaging mechanism (25) for engaging the operative ratio of the gearbox, a manually operable gear selector (60) allowing the operator to manually select the operative ratio of the gearbox when the transmission is acting in a manual mode, and an electronic control means (36) which controls the disengagement and engagement of the drive clutch at start-up and halting of the associated vehicle and during gear changes and which also determines which gear ratio is to be selected when the transmission is acting in an automatic mode, the transmission being characterised in that the manually operable gear selector (60) is arranged to enable the operator to override the current automatically selected ratio, and the transmission then remains in manual mode if an override is actioned until the operator switches the transmission back to its automatic mode or a predetermined time period has elapsed.
- 2) A transmission according to Claim 1 characterised in that a steering column-mounted stalk (60) is provided to allow the operator to override the automatically selected ratio, the stalk being moveable in a first direction (60a) to change the currently operative ratio

upwards and in a second direction (60b) to change the currently operative ratio downwards.

- 3) A transmission according to Claim 2 characterised in that the stalk (60) carries a manual/auto selection member (61) to switch between the manual and automatic modes of the transmission.
- 4) A transmission according to Claim 3 characterised in that the manual/auto selection member comprises a button (61) on the end of the stalk (60) which switches between the manual and automatic modes on each successive depression of the button.
- 5) A transmission according to any one of Claims 1 to 4 characterised in that a visual display is provided which indicates whether manual or automatic mode is operative.
- 6) A transmission according to Claim 5 characterised in that the visual display indicates when reverse or neutral are selected in the auto mode and which ratio is currently selected when in the manual mode.
- 7) A transmission according to claim any one of Claims 2 to 6 characterised in that the stalk (60) is rotatably (Y) about its longitudinal axis (X) to predetermined rotational positions which select neutral, drive and

reverse drive conditions when in automatic mode in addition to being pivotable in the first and second direction about an axis perpendicular to its longitudinal axis to shift upwards and downwards in the transmission.

- 8) A transmission according to any one of Claims 2 to 7 characterised in that if the transmission is in neutral moving the stalk (60), or button (61) if fitted, will not give a drive condition to guard against accidental movement of the associated vehicle.
- 9) A transmission according to any one of Claims 1 to 6 characterised in that selector buttons are provided to select the reverse, neutral and drive conditions when in the automatic mode.
- 10) A transmission according to any one of Claims 1 to 6 characterised in that the reverse, neutral and drive conditions when in automatic mode are selected by a floor mounted lever (24).
- 11) A vehicle transmission constructed and arranged substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

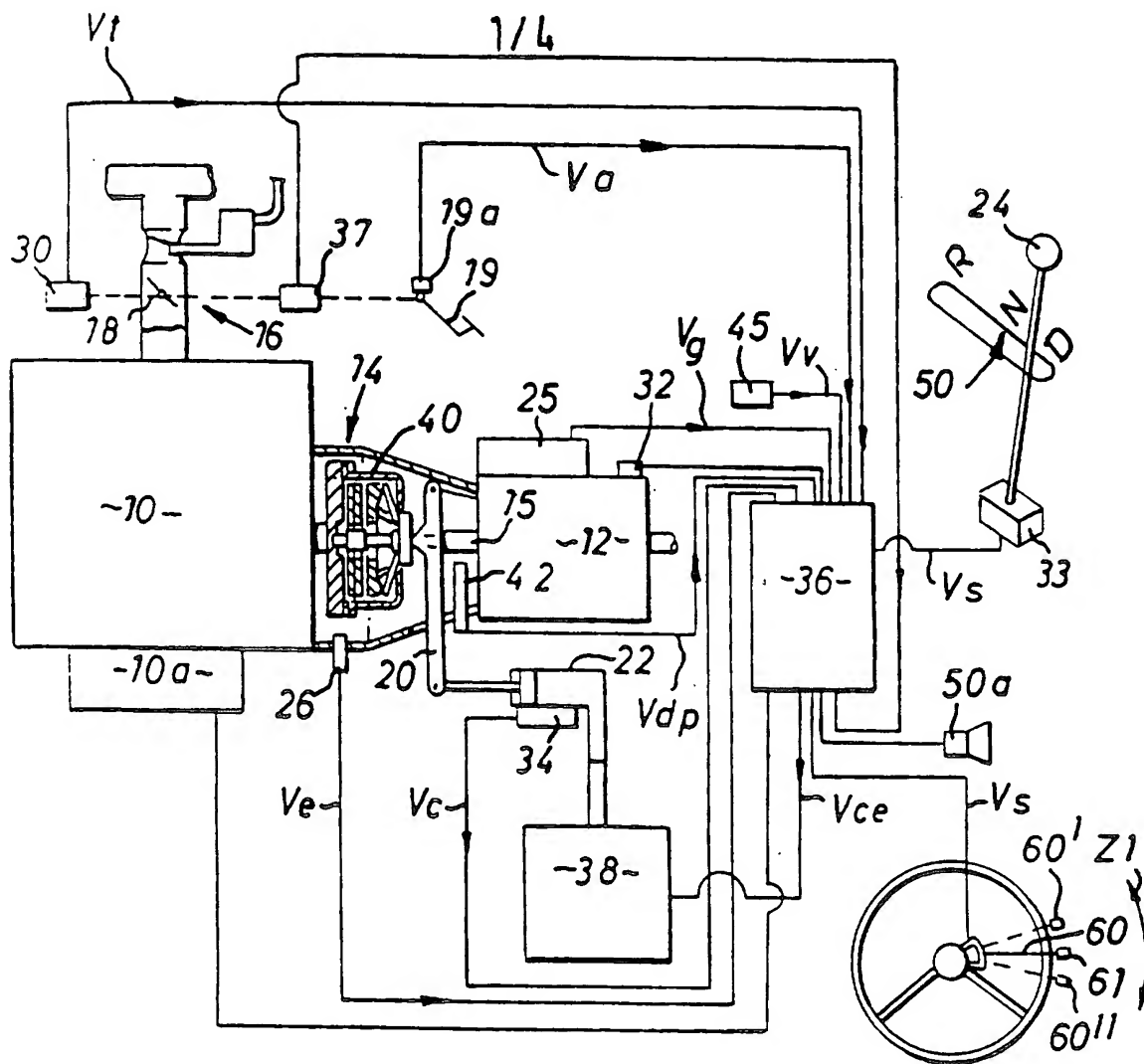


FIG. 1

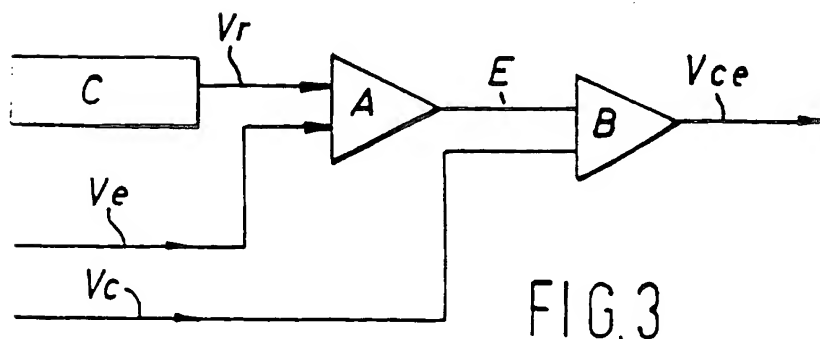


FIG. 3

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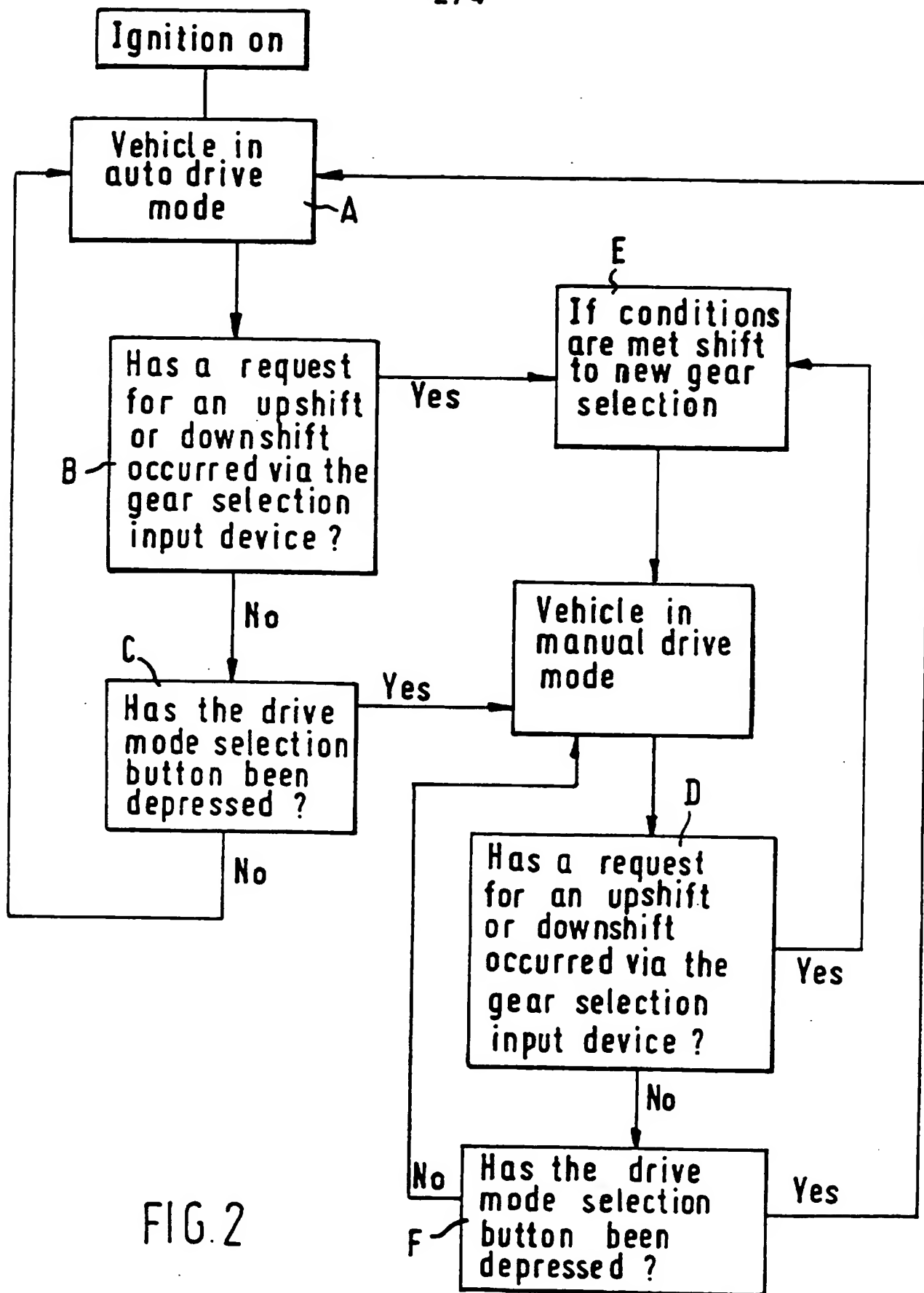
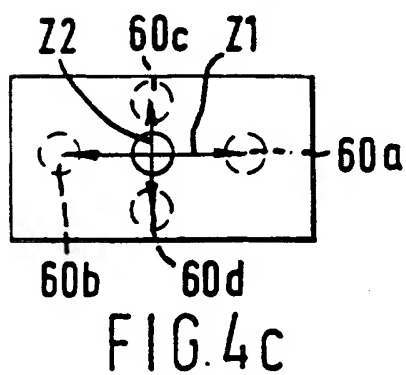
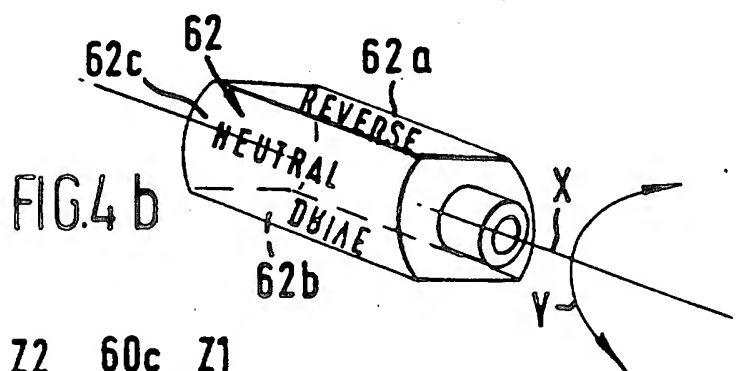
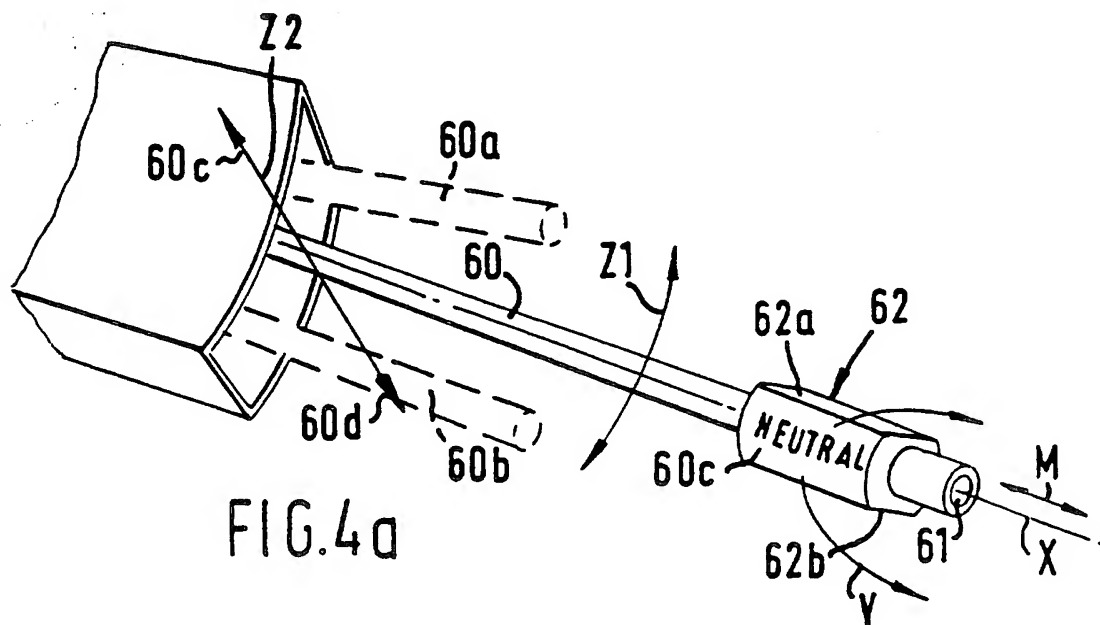


FIG. 2

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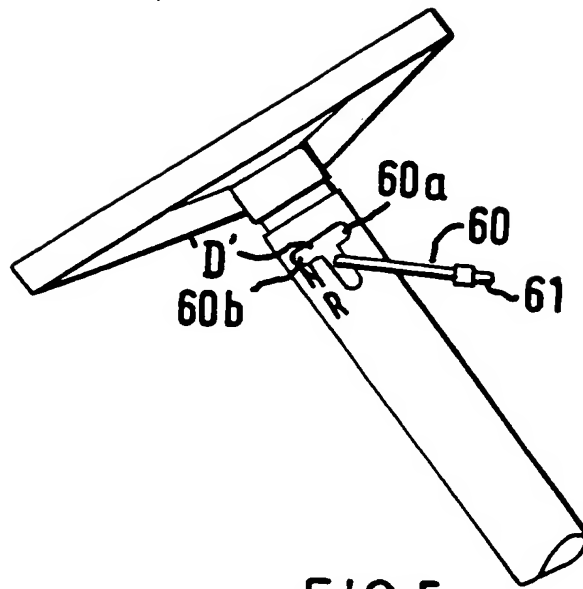


FIG. 5

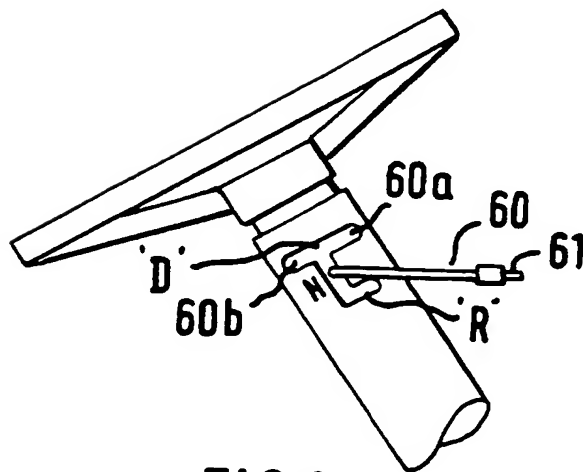


FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB.96/00871

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B60K41/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B60K F16H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 565 257 (EATON) 13 October 1993 see the whole document	1,5,8,9, 11
X	EP,A,0 444 250 (PORSCHE) 4 September 1991 see the whole document	1-6,10
X	DE,A,42 33 938 (BMW) 14 April 1994 see the whole document	1,2,7,8
X	DE,A,43 11 886 (PORSCHE) 13 October 1994 see the whole document	1,2,10

☐ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

10 July 1996

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Inter- national Application No
PC 1/GB 96/00871

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DE-A-4311886	13-10-94	NONE	

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